REMARKS – General

By the above amendment, the applicant has rewritten all the claims to define the invention more particularly and distinctly so as to overcome the technical rejections and define the invention patentably over the prior art.

The References and Differences Of The Present Invention Thereover

Applicant will discuss the reference and the general novelty of the present invention and its unobviousness over the reference.

Snelling et al. (US Patent 6,418,131) discloses a "system for connecting PSTN lines to telephones, handsets, computers, telecopy machine and other end user interfaces or consumer electronics devices in residence or business" (see ABSTRACT). It is a system with one central unit equipment NCU communicates with plurality of other devices or units in a certain location such as residence (see Fig 1). The NCU, WAU, mobile handsets are different type of equipment or devices having different functions in the same communication system. More specifically, this system needs to have one central equipment NCU, plurality of terminal devices handsets, and plurality of access units WAU. Jones (US Patent 5,410,737) disclosed a frequency agile sharing technology (FAST) system for controlling frequent usage in a communication system. Jones mentioned use directional antenna to improve the interference between the PCS base stations and other facilities.

The last O.A notes that Snelling et al.'s system has a similar embodiment to applicants invention, except failed to use directional antenna.

However in general, Snelling et al.'s invention disclosed a system of phone communication for residence and business with one Network Control Unit (NCU) and plurality of handsets and WAU in a certain area (see Fig 1). Where the NCU is the center of the whole communication system, and, WAU and handsets are the terminals. Because of targeting wireless telephony for resident area and business area, (Fig.1) all the radio units of Snelling et al. are short distance and non directional, and the system functions such as signal routing and switching are circuit connection orientated. Even though it may carry digital data, this system's design and function are different than a packet orientated computer networking system. The Applicant's present invention discloses a Fixed Wireless Networking Extender (FWNE) device and its functions of networking among many different networks. One FWNE device is network communicating with other equipment in the network on an equal base. There is not central unit and terminal unit in applicant's present invention.

Snelling et al.'s embodiment functions connecting to PSTN wires and rebroadcast phone signal via Radio Multiplex Engine 670, and then RF radio to remote handsets and WAU. Rebrocast and reorganize of PSTN line signal to RF link is a complete different function than digital computer networking communication. The Applicant's present invention embodiment comprise plurality of wireless networking radio unit each with it's own antenna and each networking with different remote wireless networking device and remote network. The FWNE device of the applicant's present invention can networking different type of networking devices, which have with same type of wireless networking function as one of FWNE's wireless networking unit.

Snelling et al. disclose a phone networking platform comprise plurality unites of NCU, processor unit, and personal computer, WAU and so on, that need be deployed and function in a scattered area such as many places of a residence

(Fig.1). Applicant's embodiment discloses a single unit system with networking capability and other functions. This system unit comprises plurality of functional networking units connect to one processor unit via system bus I and II.

The Applicant's present invention has simpler system architecture and different networking function over Snelling et al. The Applicant's present invention provides a flexibility of networking a much bigger communication system with different networking equipments. As long as a networking equipment can communicate with one of the networking units of the FWNE device, the network can be extend.

The Claim 1-5 and 7-9 rejections under 35 U.S.C. 102(e) as being anticipated by Snelling et al. (US Patent 6,418,131) has been overcome

The last O.A. rejected the Claims 1-5 and 7-9. Applicant requests reconsideration of these rejections.

Rejection of Claim 1 On Snelling et al. has been overcome

Snelling et al. (see col.9 lines 15-45) disclosed a "Control Processor 685" for commanding switching, routing, RF, accessory and other functionality implemented in CAB 660, Radio Transceiver 680 and other circuits in NCU 100. Because of different system architecture between Snelling et al. and the Applicant's present invention, the system software and networking software are completely different in both systems. For example, Snelling et al. software need to "step-by-step, lines 640 are match in the CAB 660 to various WAUs 200, handsets 300 and other devices (col.9 25-32)"; However, the processor unit 164 of the Applicant's present invention "performs the networking features such as routing, bridging and etc, and also networking management functions". These two inventions have complete different system software with different function

and purposes. Snelling et al.'s Control Processor 685 has the function to control Radio Transceiver 680, it is different the processor unit 164 of the Applicant's present invention which functions with wireless networking radio units 102, 112, 122, 132. A Radio Transceiver is a device that both transmits and receives analog or digital signals. A wireless networking radio typically comprises radio a RF front-end, a baseband processing unit, and media access control unit. It is a much more complicated device. In conclusion, the processor unit 164 of the Applicant's present invention is completely different than Snelling et al.'s Control Processor 685, and with much more sophisticated system and networking capability.

Snelling et al. disclosed a NCU (fig 3A-3C, col.5 25 – col.12 30). Also, Snelling et al. (see 720,750, fig.3A), disclosed two buses to which where "radio multiplex engine 670" is connected to bus 750, while "network interface to PSTN (wired lines) 650" is connected to bus 720. Further, bus 750, and 720 need be inter-connected to the "switching, bridging and accessory circuitry as shown 660 (see col.5 line 33-34)". The two buses of Snelling et al. 720, 750 belong to switching, bridging and accessory circuitry 660 but not the control processor 685. In the present invention of applicant, two system buses are direct system bus extension of processor unit (fig.1) where wired and wireless can be both attach to. As example shown in (fig.1 of present invention), radio unit 102, 112 and wired networking units 167,168 are connecting to bus I 161. And there is no "switching, bridging and accessory circuitry" in Applicant's present invention. Because of the two buses of Snelling et al. 720, 750 belong to switching, bridging and accessory circuitry 660, these two buses are simply cross-connecting, switching and bridging among the PSTN (phone) lines. These types of bus are much simpler and much less functional that a system bus that directly connected to processor. It is obvious that the bus architecture of the Applicant's present invention is completely different and more sophisticated than Snelling et al.'s.

Snelling et al. (see fig.4 and col.7 line 65-66) disclosed plurality of "Wireless Access Units 200 and/or handset 300 as programmed in Control Processor 685". These device / units are deployed outside of NCU as mobile or remote devices (Fig1). They communicate with NCU 100 via RF communication as client/terminal units. In the present invention of applicant, plurality of wireless unit is in the same unit and connected to system buses and processor unit 164. Multiple of FWNE devices can communicate to each other via RF links. (fig2-4). The embodiment of present invention of Applicant is completely different than Snelling et al. disclosed, and, can communicate and network with remote wireless networking equipment vs. just access terminal.

Snelling et al. (see fig.7) disclosed plurality of wired connection units to wired network for phone service via RJ-11 JACKs, where signal pass through transformer A1, Hybrid A2, CODE A3, and then enter ASIC A13, and then enter to radio transceiver A15 and antenna. Snelling et al. disclosed a plurality of wired phone connections with discrete components RJ-11 JACK, A1, A2, A3 and RD RING DETECT unit. Assuming we consider the combination of the above discrete as a whole unit, this unit is connected to ASIC A13 with CODEC interface. The Microprocessor A14 picks up the signal from RD RING DETECT and performs control to ASIC A13. The embodiment of Applicant's invention comprises a plurality of wired networking unit with wired networking capability such as fiber networking, Ethernet networking to wired network. As shown on fig.1, all of these wired networking unit are connected to computer system BUS I and BUS II, and function with processor directly. It is obvious the wired networking unit of applicant's present invention is different and has more sophisticated network communication functions than Snelling et al.'s disclosure where the wired networking unit is just a plain phone communication circuitry with voice CODEC.

In conclusion, the system architecture of Applicant's present invention provides advantage over Snelling et al. with less function blocks, simpler system architecture, better system integrity, easier installation. The FWNE device of Applicant's present invention can extend the communication network to many more devices and scale vs. Snelling et al.'s disclosure which can only extend the communication from NCU to terminal device handset or WAU. The FWNE device of Applicant's present invention has much more sophisticated network communication capability than Snelling et al.'s disclosure.

The applicant has rewrite the claim 1 to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

The Rejection of claim 2 On Snelling et al. has been overcome

Snelling et al. (see col.7 line 61 though col.8 line 31) disclosed a CAB 660 design with local control processor 685 and personal computer 687. And it is "under the control of a local Control Processor 685 and personal computer 687 (col.7 line 62-63)". Snelling et al. provide a combined system platform for voice and date package exchange among the NCU interfaces. The embodiment of applicant's invention provides system platform with only one processor unit and two system buses. There is not addition personal computer needed in Applicant's present invention.

Snelling et al. (see col.7 line 61 though col.8 line 31) disclosed a CAB 660 design to route, switch voice and data signal between PSTN Network Interface 651 (Fig.3A) and Radio Multiplex Engine 670. The networking function of routing, switching voice and data signal between PSTN Network Interface 651 (Fig.3A) and Radio Multiplex Engine 670 is different than the networking function of exchanging networking packets among the wired networking units and wireless

networking radio units. The networking system function of the Applicant's present invention exchanges networking packets among the wired networking units and wireless networking radio units. There are not additional control processor 685 and PC 687 needed in Applicant's present invention in order to perform the networking functions. Thus, the Applicant provide a much simpler system architecture of system platform with different networking function over prior art of Snelling et al.

Further, plurality of FWNE equipments of applicant's present invention can network together to form a bigger topology of a communication network. This is part of extension function of FWNE system. The prior art of Snelling et al. one NCU communicates with plurality of WAU and handset to form the communication network. The wireless extension of Snelling et al. limited between a central unit NCU and plurality of WAUs and handsets. The system function of applicant's present invention has a much wider of networking capability over Snelling et al. For example, the FWNE device can network with and equipment with the same type of wireless networking capability, such as another FWNE device. Note that Snelling et al. disclosed a system comprises one NCU 100, WAU 200, handsets 300 and wireless Control/Monitoring Accessories 350. (see col.13 line 35-40). This is a system with NCU 100 as center star network topology (see col 13 line 57-60) communicating with remote terminal devices such as handsets 300. It is obvious that multiple of FWNE can be flexibly networked together and form and much bigger wireless communication network. Snelling et al's embodiment is only a star topology local communication network with 4 different types of devices, and one of them has to be the central unit NCU 100.

The applicant has rewrite the claim 2 to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

The Rejection of claim 3 On Snelling et al. has been overcome

Snelling et al. (see col.2 lines 65 through col.3 line 45) disclose a possible wireless modular connectivity between any desired devices and the PSTN with the residence. This is an embodiment of extending the PSTN network to wireless handset users. All of the digital radio modem 680 of Snelling et al. can be modular selectable but need to connected to a radio multiplex engine 670. The embodiment of applicant's invention disclosed a wireless networking radio unit modular architecture connected to processor system bus directly without the radio multiplex engine 670 of Snelling et al.. Further, because of the two buses of applicant's present invention are direct connected to processor unit with much more bus capability, the wireless networking unit has more networking and communication function than the digital radio modem 680 of Snelling et al.. The embodiment of applicant's invention has a better system architecture with fewer components, and, more flexible and capable system functions than Snelling et al.'s disclosure.

The applicant has rewrite the claim 3 to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

The Rejection of claim 4 On Snelling et al. has been overcome

Snelling et al. (see col.13 line 55-65) disclose a NCU 100 to selects RF channels of whole entire network (of the residence). Because of the system architecture advantage the Applicant's present invention over prior art, when plurality of same type of wireless networking radio unit working in the same FWNE system with different channel, all the wireless networking radio units are connected to processor system bus directly without a radio multiplex engine 670 of Snelling et al.. The embodiment of has a better system architecture with fewer components,

and, more flexible and capable system functions than Snelling et al.'s disclosure. Further, because of simpler one unit architecture, the FWNE device of applicant's present invention can be installed difficult geographical location, and with directional antenna to provide a better RF separation. Thus improve system reliability and function of the whole system. The wireless networking radio unit modular channeling of Applican't present invention has advantage of simpler system architecture and provides better function for application over Snelling et al. Because of the function of the RME 670 of Snelling et al. (see col.5 line 52-60) is only "multiplexes the signales", the networking function of the NCU if any, is performed some where else. Thus, it is very limited. Accordingly, another advantages of connecting direct to system bus as disclosed by applicant's present invention is allowing system to perform more complicated networking and communication functions.

The applicant has rewrite the claim to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

The Rejection of claim 5 On Snelling et al. has been overcome

Snelling et al. (see col.13 line 1-15) disclosed a digital Wireless Access Unit 200 shown in Fig6. Where the unit work as a wireless extension of ISDN lines, and " performing a buffering, error control, and protocol conversion function". This WAU has a different embodiment than the FWNE device of applicant's present invention. Further, the FWNE device of applicant's present invention is a self-contained complete function networking communication device. The WAU of Snelling et al. is just an ISDN line extension unit to computer via MICROPROC PORT (Fig.6). It is obvious that FWNE can perform much sophisticated networking and communication functions than the WAU of Snelling et al.

Note that Snelling et al (see Fig 6) disclosed a TDD/TDMA radio transceiver A35. A radio transceiver is a simple communication device that dose radio signal transmit and receive. Selection of different radio transceiver is un-equivalent to selection of different wireless networking radio units as disclosed by applicant's present invention.

In applicant's invention where the different type of wireless networking radio units are modular units that interfacing to the main system via BUS I or II.

The applicant has rewrite the claim to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

Rejection of claim 7 On Snelling et al. has been overcome

Snelling et al. (see col.3 lines 9-30) disclose an addition node device that is standalone device to which "base units or network control units can report information" and "Such information at the node can be useful for purposes such as help desk functionality, design modifications, and adjustment of the operation". This is a special standalone device functions among the communication system formed by NCU and many other device as a standalone equipment for coordination of whole system. The radio control unit of applicant's invention is a built-in function unit inside the FWNE system for the purpose of controlling the performance of networking radios inside the FWNE device. The function, purpose, and implementation if applicant's invention is complete different then the "node device" disclosed by Snelling et al.

Compare to Snelling et al., the Applicant's present invention dose not need an additional standalone equipment to do the system information control among different equipments of the communication system. When forming a high

capacity communication network with many different radio communications, it is much easier to manage the radio modules inside each device like the Applicant's present invention, than a stand alone control node disclosed by Snelling et al.

The applicant has rewrite the claim to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

The Rejection of claim 8-9 On Snelling et al. has been overcome

Snelling et al. (see col.8 line 60 through col.9 line 15) disclosed a "NCU switching, Bridging and Accessory Block functionality" (CAB 660, see col.7 line 37) "may reside on board the NCU". According to Snelling et al. (Fig. 3A, and see col. 7 lines 37- 68) a switching, Bridging and Accessory Block (CAB 660) provides a bus cross connection between Network Interface to PSTN 650 and Radio Multiplex Engine 670. Even if all the Fig.3A of Snelling et al. except PC 687 to be building one board and integrate PC 687 into one complete unit, this is still not a one board solution. Further the cost and complexity make almost impossible to build the whole Fig.3A into on board due to the nature of Snelling et al. architecture.

In Applicant's present invention all the wireless networking radio units and wired networking units may be modular and/or build on one PCB. These units maybe turn on or off to configure the FWNE device with different networking function capability. Because there is not additional PC needed, the embodiment of Applicant's present invention can be a one broad device with provide multiple combination of features. Apparently, the Applicant's present invention provides a significant advantage over Snelling et al. with better system integrity, smaller size, easier installation, less cost, simpler system integration and more function.

The applicant has rewrite the claim to reflect the differences and novelty over prior art. Accordingly applicant submit that the new claim dose comply with § 102 and therefore requests withdrawal of this rejection.

Snelling et al. And Jones Do Not Contain Any Justification To Support Their Combination, Much Less In The Manner Proposed

With regard to the proposed combination of Jones radio unit with directional antenna to put on the facility and other base stations, it is well know that in order for any prior-art reference themselves to be validly combined for use in a prior-art § 103 rejection, *the references themselves* (or some other prior art) must suggest that they be combined. E.g., as was stated in In re Sernaker, 217 U.S.P.Q. 1.6 (C.A.F.C. 1983):

> "[P]rior art references in combination do not make an invention obvious unless something in the prior art references would suggest the advantage to be derived from combining their teachings."

That the suggestion to combine the references should not come from applicant was forcefully stated in Orthopedic Equipment Co. v. United States, 217 U.S.P.Q. 193,199 (CAFC 1983):

> "It is wrong to use the patent in suit [here the patent application] as a guide through the maze of prior art references, combining the right references in the right way to achieve the result of the claims in suit [here the claims pending]. Monday morning quarterbacking is quite improper when resolving the question of nonobviousness in a court of law [here the PTO]."

As was further stated in Uniroyal, Inc. v. Rudkin-Wiley Corp., 5 U.S.P.Q.2d 1434 [C.A.F.C. 1988], "[w]here prior-art reference require selective combination by the court to render obvious a subsequent invention, there must be some reason for

the combination other than the hindsight gleaned from the invention itself. .... *Something in the prior art must suggest the desirability and thus the obviousness of making the combination."*[Emphasis supplied.]

In line with these decisions recently the Board stated in Ex parte Levengood, 28 U.S.P.Q.2d 1300 [P.T.O.B.A.&I. 1993]:

> "In order to establish a *prima facie* case of obviousness, it is necessary for the examiner to present *evidence,* preferably in the applied prior art, or in the form of generally available knowledge, that one having ordinary skill in the art *would have been led to* combine the relevant teachings of the applied references in the proposed manner to arrive at the claimed invention. ... That which is within the capabilities of one skilled in the art is not synonymous with obviousness. ... That one can *reconstruct* and/or explain the theoretical mechanism of an invention by means of logic and sound scientific reasoning does not afford the basis for an obviousness conclusion unless that logic and reasoning also supplies sufficient impetus to have led one of ordinary skill in the art to combine the teachings of the reference to make the claimed invention. ... Our reviewing courts have often advised the Patent and Trademark Office that it can satisfy the burden of establishing a *prima facie* case of obviousness only by showing some objective teaching in either the prior art, or knowledge generally available to one of ordinary skill in the art, that 'would lead' that individual 'to combine the relevant teachings of the references.' ... Accordingly, an examiner cannot establish obviousness by locating references which describe various aspects of a patent applicant's invention without also providing evidence of the motivating force which would impel one skilled in the art to do what the patent applicant has done."

In the present case, there is no reason given in the last O.A. to support the proposes combination.

The O.A. Noted [p.4] to modify the system of Snelling et al. with the directional antenna teaching of Jones is in appropriate. Because Snelling et al.'s wireless communication system is in the field of home mobile wireless communication, (see Abstract) where radio frequency is lower, need and have non-directional coverage in order for all the mobile unit can communicate with the base unit while moving. A directional antenna at lower frequency is big in size. Also, a direction antenna at is a heavy and structural equipment. It is very hard to install and use in home environment and handset. Applicant submits that the fact that combination is impossible.

Further, even if assuming Snelling et al. use an ultra high frequency microwave radio not a CDMA system as mentioned. Then because of highly directional antenna, the base unit can only possible communicate with mobile unit in one direction, and the mobile unit can only communicate to base only within that directional area and it's own antenna pointing towards base unit only. This is another obvious reason of not to combine the both system.

Further more, the higher the radio frequency, the smaller the directional antenna size, the weaker of RD wave penetration capability. If assuming Snelling et al. use an ultra high frequency microwave radio that with very small directional antenna, then the whole wireless communication became failure because of RF wave is blocked by many obstructions in home or businesses environment. Then in order for the communication to available, the Snelling et al.'s system combine with directional antenna teaching of Jones needed to be install in outdoor open environment, like the test suggest by Jones. However, none of the Snelling et al.' devices is designed to be outdoor long distance application. (see Fig.1); it is impossible to install the complicate Snelling et al.' design in any open environment, such as tower or roof top.

Applicant therefore submits that combining Snelling et al. and directional antenna teaching of Jones is not legally justified and is therefore improper. Thus the applicant submits that the rejection on these references is also improper and should be withdrawn.

Applicant respectfully request, if the claims are again rejected upon any combination of references, that the Examiner include an explanation, in accordance with M.P.E.P § 706.02, Ex parte Clapp, 27 U.S.P.Q. 972 [P.O.B.A. 1985], and Ex parte Levengood, supra, a "factual basis to support his conclusion that it would have been obvious" to make the combination.

The Novel Physical Features Of Claim 6, Produce New And Unexpected Results And Hence Are Unobvious And Patentable Over These References Under § 103

Also applicant submits that the novel physical features of claim 6 are unobvious and hence patentable under § 103 since it produce new and unexpected results over prior arts, or any combination thereof.

These new and unexpected results are the ability of applicant's apparatuses to accommodate and provide high quality and broader wireless networking and deployment capability. Applicant's apparatuses therefore are vastly superior to that of either Snelling et al. and Jones and of any possible combination thereof. There novel features of applicants apparatuses which effect these differences are, as stated, clearly cited in new claims

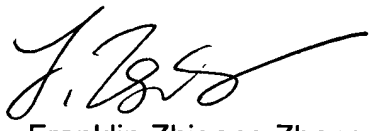
Conclusion

For all of the above reasons, the applicant submits that the specification and claims are now in proper form, and that the claims all define patentably over the prior art. Therefore he submits that this application is now in condition for allowance, which action he respectfully solicits.

Conditional Request For Constructive Assistance

Applicant has amended the claims of this application so that they are proper, and define novel structure which is also unobvious. If, for any reason this application is not believed to be in full condition of allowance,
Applicant respectfully request the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. § 2173.02 and § 707.07(j) in order that the undersigned can place this applicant in allowable condition as soon as possible and without the need for further proceedings.

Very respectfully,



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07-13-05

IFW

Patent Application of Franklin Zhigang Zhang

for

TITLE: FIXED WIRELESS NETWORK EXTENDER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Provisional Patent Application Ser. No. 60/252,028 filed 11/18/2000.

BACKGROUND – FIELD OF INVENTION

This invention relates to a network device for fixed wireless networking, specifically to improving fixed wireless networking deployment.

BACKGROUND – DESCRIPTION OF PRIOR ART

Fixed wireless networking uses wireless communication radios to create digital data network links between multiple networking devices and/or networks. For wireless networking, a pair of wireless bridges connects two remote networks together ~~forms~~ forming a point-to-point wireless link; an Access Point (AP) communicates with multiple remote Subscribe Units (SU) [[forms point to multi point wireless]] forming point-to-multi-point wireless connections. Wireless Point Of Presents (WPOP) is built for outdoor wireless network deployment. WPOP works as a central access node for multiple remote wireless networking devices. To perform the networking features, WPOP comprises more than one AP and/or other wireless networking devices to form the wireless links with remote wireless devices; and also, comprises a router and/or ATM switch to interface to wired network. One or more WPOP form a fixed wireless network.

[[Radios for wireless networking especially broadband wireless network]] Broadband wireless networking radios are different from cellular phone radios. [[Higher radio frequency (Microwave) is adopted in the wireless networking technology.]] Broadband wireless networking radios operate at high radio frequency (Microwave). Line Of Sight (LOS) [[is needed]] is necessary for the microwave wireless network radio technology. Different wireless networking radios also are characterized with different radio frequency, gain, and communication protocol. One wireless networking radio can only communicate with other radios under the condition of Line Of Sight, same radio frequency, same communication protocol, and within the distance limited by the transmitting gain regulations.

Typical WPOP always has wired network connections to link the wired and wireless networks together. WPOP also comprises multiple wireless networking devices, router and/or ATM switch and other support accessories to provide higher bandwidth, more connections to remote clients, and avoid interferences. WPOP usually requires high bandwidth, high reliability connection, such as, T1 or T3 wired connection, or licensed

band high-class backbone radio. So WPOP location must be well connected and has physical capability to accommodate multiple expensive electronics equipments. It is very complicate and high costly to setup WPOP.

WPOP of fixed wireless network serves as a regional center node of wireless links with a limited distance of radiation coverage area. In order to have LOS communicate with remote devices, fixed wireless network WPOP must be located at high geographical locations, such as on the top of a high building or a high tower. However: 1) [[even though]] even within the WPOP coverage area, a remote device may not be able to communicate with WPOP because of non-LOS. LOS is not always available because of there might be a tall building or other geographical obstacle blocks the link between WPOP and remote device; 2) Remote device site is not always within the coverage of WPOP. In order to get connected, additional WPOP need to be setup as a repeater site. It can be very costly to do it.

Summary

A Fixed Wireless Network Extender (FWNE) device serves as a wireless extension node and improves the deployment of fixed wireless networking greatly. The device comprises system buses on which the networking modules can be attached to; a system processor unit which works as the operation platform also performs networking functions; a radio control unit which can monitor and control radio units; ~~multiple~~ a plurality of wireless network radio units which connect to the device via PCMCIA control units or system buses directly. By integration of the different types of the wireless network radio units, the FWNE can communicate with multiple different fixed wireless networks, [[and work as a multifunction]] and works as a multifunctional fixed wireless networking node. The device

can also work as a repeater node to overcome the non Line Of Sight issue and extend the coverage of wireless network.

Objects and Advantages

Accordingly, several objects and advantages of my invention are:

(a) to provide a wireless networking device, which is able to perform multiple wireless networking functions in one box;

(b) to provide a wireless networking device which is able to connect with multiple wireless and wired networks;

(c) to provide a wireless networking device which is able to connect with multiple different wireless and wired networks;

(d) to provide a wireless networking device which is able to extend the wireless network range by joint multiple different wireless network together;

(e) to provide a wireless networking device which requires less installation conditions than the prior art of WPOP;

(f) to provide a wireless networking device which can be easily deployed to a geographical location to solve the non Line Of Sight issue of the prior art of WPOP;

Still further objects and advantages will become apparent from a consideration of the ensuing description and accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a block diagram of the FWNE device [[with plurality individual]] <u>with a plurality of individual</u> wireless networking radio units and wired networking units.

Fig. 2 is a schematic representation of fixed wireless network extension deployment utilizing the FWNE device.

Fig. 3 is a schematic representation of utilizing the FWNE device as a center node for fixed wireless network deployment.

Fig. 4 is a schematic representation of utilizing the FWNE device as a bandwidth distribution node for fixed wireless network deployment.

Fig. 5 is a schematic representation of utilizing the FWNE device as a main node for a wired [[main network connects to plurality]] main network connecting to a plurality of sub networks via different fixed wireless links.

Reference Numerals

10 the FWNE device
101,111,121,131 directional antenna
102,112,122,132 wireless networking radio unit1, 2,3,4
140,141 PCMCIA controller and interface circuit
161,162 system bus1, 2
163 radio control unit
164 processor unit
165,166,167,168 wired networking unit1,2,3,4

21,22,23 network1,2,3
211,221 directional antenna
212,222 wireless link
31,32,33 network1',2',3'

311,321,331 directional antenna

301,302,303 wireless link

41 remote main network

42,43,44 sub network1,2,3

422,432,442 directional antenna

411,421,431,441 wireless link

51 wired main network

513,523,533 sub network1',2',3'

511,521,531 wireless link

512,522,532 directional antenna

SUMMARY Including Objects and Advantages

A Fixed Wireless Network Extender (FWNE) device serves as a wireless extension node and improves the deployment of fixed wireless networking greatly. The device comprises system buses on which the networking modules can be attached to; a system processor unit which works as the operation platform also performs networking functions; a radio control unit which can monitor and control radio units; multiple wireless network radio units which connect to the device via PCMCIA control units or system buses directly. By integration of the different types of the wireless network radio units, the FWNE can communicate with multiple different fixed wireless networks, and work as a multifunction fixed wireless networking node. The device can also work as a repeater node to overcome the non Line Of Sight issue and extend the coverage of wireless network.

DESCRIPTION-Preferred Embodiment

As shown in Fig.1, the FWNE device 10 comprises four individual wireless network radio units 102, 112, 122, 132 and wired networking units 165, 166, 167, 168. Each radio unit 102, 112, 122, 132 connects to its own directional antenna 101,111,121,131. In combining with its own directional antenna, each radio unit can be configured to communicate with the remote wireless device. Those four radio units 102, 112, 122, 132 can be different types of wireless networking radios. The FWNE device 10 has one processor unit 164 to perform the networking features such as routing, bridging and etc, and also networking management functions. The FWNE device 10 comprises a radio control unit 163, which controls the physical layer performance of each radio. The FWNE device 10 also has two buses 161, 162, which the radio units 102,112,122,132 and the wired networking units 165,166,167,168 are connected to. The bus1 161 is ISA bus, which the radio units 102 and 112 are connected to via PCMCIA controller and interface circuits 140, 141. The bus2 162 is PCI bus, wired unit1 165 and unit2 166 are connected to directly.

Fig. 2

The FWNE device 10 is working as a remote node for the network1 21 to connect to network2 22 wirelessly and network3 23. In this embodiment, the FWNE device 10 is configured with two wireless networking radio units102, 112 and the wired networking unit 165. The distance between network1 21 and network2 22 is longer than the range of the wireless radio units can reach, or the Line Of Sight (LOS) is unavailable for them to establish a direct wireless connection. The radio unit 102 and antenna 101 of the FWNE device 10 is configured with the ability to [[communicate to the radio]] communicate with the radio of the far end network1 21; Radio unit 102 and Antenna 101 communicate with antenna 211 and the radio behind it form the wireless link 212. The radio unit 112 and antenna 111 of the FWNE device10 is configured with the ability to [[communicate to the radio]] communicate with the radio of network2 22; radio unit 112 and Antenna 111 communicate with antenna 221 and the radio behind it form the wireless link 222. Also there may be a wired network 165 connects to the wired unit of

FWNE device 10 .The processor unit 164 of the FWNE device 10 handles the networking packets according to the network configuration. The FWNE device 10 extends the range of the network1 21 to network2 22. This is a simple application of the FWNE device 10.

Fig.3

In this embodiment, the FWNE device 10 is configured with three wireless networking radio units102, 112, and 122.Radio unit1 102 with antenna 101 communicates to network1' 31 via antenna 311 and the radio behind it; Radio unit2 112 with antenna 111 communicates to network2' 32 via antenna 321 and the radio behind it; Radio unit3 122 with antenna 121 communicates to network3' 33 via antenna 331 and the radio behind it. The processor unit 164 of the FWNE device 10 handles the networking packets among three networks 31,32,33 according to the network configuration. Each of the wireless networking radio unit [[communicates to remote]] communicate with the radio same type of wireless network radio. The most comment function of this embodiment is that FWNE device 10 working as a multi port router or multi protocol bridge.

Fig. 4 shows utilizing present invention as a distributing node for fixed wireless network. In this embodiment, the bandwidth for remote main network 41, such as Internet, is distributed via the FWNE device 10 to three sub networks: sub network1 42, sub network2 43, sub network3 44 wirelessly. The FWNE device 10 is configured into one main link 411 radio channel, and three sub link radio channels 421,431,441.

Fig. 5 shows utilizing present invention as a main node for a wired main [[network connects to three]] network communicating with three sub networks via different directional fixed wireless links. In this embodiment, the FWNE device 10 is configured with three different radio units 102,112,122 and antennas 101,111,121. Among which: (1) The radio unit1 102 and antenna 101 is [[communicating to remote]] communicating with remote wireless networking device 512, so as to link the sub network1' 513 to the wired main network 51. The wireless link 511 between antenna 101 and remote wireless

networking device 512 has [[it own wireless link characteristic]] its own wireless link character including radio frequency, modulation, protocol and etc. (2) The radio unit2 112 and antenna 111 is [[communicating to remote]] communicating with remote wireless networking device 522, so as to link the sub network2' 523 to the wired backbone network 51. The wireless link 521 between antenna 111 and remote wireless networking device 522 has [[it own wireless link characteristic]] its own wireless link character including radio frequency, modulation, protocol and etc. (3) The radio unit3 122 and antenna 121 is [[communicating to remote]] communicating with remote wireless networking device 532, so as to link the sub network3' 533 to the wired main network 51. The wireless link 531 between antenna 121 and remote wireless networking device 532 has [[it own wireless link characteristic]] its own wireless link character including radio frequency, modulation, protocol and etc.

Preferred Embodiment -- Operation

The FWNE device 10 [[functions a key]] functions as a key element of the fixed wireless networking deployment. The processor unit 164 [[is computer]] is a computer processor loaded with operating system as well as networking function. The processor [[units 164 dose the]] units 164 performs the networking packets [[exchanging between the]] exchanging among the network channels. To the processor unit, all the wireless and wired networking units function as network interface. Typically, the processor unit can route, switch, or bridge the networking packets among the wireless and wired network interfaces. The whole FWNE 10 functions as a multi interface network device. By exchanging the networking packets among the networking units, the FWNE 10 extends the range of one network to another via different networking unit. Control unit 163 of the FWNE 10 controls the physical layer elements of the radios. Via control unit 163, the processor unit 164 can monitor and control the electronic of the radio units, [[and function the]] and functions the system control of the radio performance, such as additional gain control, and antenna control. The modular system design allows the FWNE [[device 10

has different]] device 10 having different configuration. In order to connect different number and/or different type of wireless and wires networks, different specific wireless networking radio units must be pre-installed and configured before installing the device to the field.

Fig 2 Operation

In this embodiment, network1 21 need be connected to network2 22 and network3 23. The range of wireless networking units can reach is shorter than the distance between network1 21 and network2 22. The FWNE device 10 is running at bridging mode as a bridge. Network3 23 is within the wired connection range of the location of the FWNE device 10, and network3 23 needs communicate with network1 21.Network2 22 is connected to the FWNE device 10 wirelessly. The bridge function of the FWNE device 10 handles transparently, thus the three networks are jointed together. The network1 21 and network2 22 extend the range to each other.

Fig.3 Operation

The FWNE device 10 is configured with three wireless networking units which are capable to communicate with each remote network device. The FWNE device 10 can operate as a bridge, or router, or switch. [[All the network]] All of the networking packets come from the three networks will be redirected to destination by the Fixed Wireless Network Extender (FWNE) device 10.

Fig.4 Operation

The FWNE device 10 works as a sub node device for a hierarchical wireless networking system. This is a typical Internet networking system. The wireless networking radio unit 102 of the FWNE device 10 is configured with the same type of the main network 41. The FWNE device 10 is working as a router, it routes the network traffic between the main

network 41 to the three sub networks 42,43,44. When applying to Internet networking, the FWNE device 10 distributes the bandwidth from the main network to the three client networks 42,43,44. One alternate operation of this embodiment is: When [[there non line]] there is not line of sight between main network 41 and three sub networks 42,43,44 or the distance is out of range, the FWNE device 10 works as repeater node as well as a extend node. The FWNE device 10 can be configured with four different wireless units. It is capable to extend the wireless network through multiple different types of wireless links, thus this provides the great flexibility to wireless networking, also greatly improves the frequency usage and minimize the interference in the networking field.

Fig.5 Operation

The FWNE device 10 functions as a router node for a wired main [[network 51 connects to]] network 51 connecting to three sub networks via different directional fixed wireless links. The FWNE device 10 distributes the bandwidth from wired main network 51 to three sub networks 513,523,533, and functions as a gateway device for those three sub networks.

Conclusion, Ramifications, and Scope

Accordingly, it can be seen that, according to the invention, I have provided a fixed wireless networking device called the Fixed Wireless Network Extender (FWNE), which provides a simple one unit node solution for fixed wireless networking deployment. The device of this invention can be deployed to many locations, which are not applicable to the prior art, and greatly extend the range of the fixed wireless network. The device of the current invention can connect to multiple different wireless networks and function as a key node, which cannot be achieved by prior art. Furthermore, the Fixed Wireless Network Extender (FWNE) device has the additional advantages in that:

- it can be configured with multiple same type of wireless networking units to expend the wireless networking capability of a single node site.
- it can [[be upgrade from]] be upgraded from the current wireless network to future generation by only changing the wireless networking radio unit and without changing the whole network system.
- it requires less power, [[because of]] due to one unit design.
- it is more environment friendly by providing the flexibility to reach the place where network needs to go, controversy to prior art needs high gain to penetrate to the remote site to get communicate and emits too much unnecessary radio frequency to the environment.
- it saves the cost when multiple different wireless networks need to joint together.
- it saves the network deployment time a lot by its one unit design.
- it provides higher system reliability than prior art of networking.
- it provides the possibility to connect the wireless network where the prior art cannot reach.

Although the description above contains much specificity, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Various other embodiments and ramifications are possible within it's scope. For example,

* The Fixed Wireless Network Extender (FWNE) device 10 can function as a complete functional WPOP, when configured with point to multipoint wireless networking units.

* Multiple Fixed Wireless Network Extender (FWNE) devices 10 may be deployed to the same location to form a high capacity WPOP.

* The Fixed Wireless Network Extender (FWNE) device 10 may be configured with only one wireless networking unit and one wired interface, and become a client site device.

* The Fixed Wireless Network Extender (FWNE) device 10 may be installed indoor or campus environment to create a mobile wireless networking environment.

* The Fixed Wireless Network Extender (FWNE) device 10 may not comprise the radio control unit 163, when all the radio units do not require additional control.

* The Fixed Wireless Network Extender (FWNE) device 10 may comprise the antennas for the wireless networking radio units.

* The wireless networking radio units may be built on the same PCB, and configure the device by turn on and off each units;

* The Fixed Wireless Network Extender (FWNE) device 10 may be used in indoor environment, when configured with multiple different wireless networking radio units and indoor antennas, the Fixed Wireless Network Extender (FWNE) device 10 can create a high capacity indoor wireless environment for multiple different wireless devices.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

Claims:

Claim 1-9 (cancelled)

10 (new). A fixed wireless network extender (FWNE) device comprising:

one processor unit

a plurality of system buses

one control unit monitors and controls the performance of the radio units

a plurality of wireless networking radio units

a plurality wired networking units

wherein processor unit running system software and computer networking software; and

Whereby said a plurality of wireless networking radio units are attached to said system buses; and

Whereby said a plurality of wireless networking radio units may be attached to said system buses via interface means; and

Whereby said a plurality of wired networking units are attached to said system buses.

11 (new). The FWNE device of claim 10 wherein the processor unit having networking features means for processing computer networking packets among said wireless networking radio units and wired networking units.

12 (new). The FWNE device of Claim 10 wherein having selective number and type of said wireless networking radio units for different networking applications.

13 (new). The FWNE device of Claim 10 wherein said wireless networking radio units having same type and working at different RF channels.

14 (new). The FWNE device of Claim 10 wherein said wireless networking radio units having same type and working with different RF isolation means for avoiding self-interference.

15 (new). The FWNE device of Claim 10 wherein the radio control unit is an optional unit for said wireless network radio units needing additional hardware controls

16 (new). The FWNE device of Claim 10 wherein said wireless networking radio units are built on the same PCB.

17 (new). The FWNE device of Claim 16 wherein having configuration means for turning on and off each said wireless networking radio units.

18 (new). Apparatus according to claim 10 for interconnecting a plurality of networks, comprising:

one said FWNE device of claim 10 having a plurality of said wireless networking radio units; and

communicating a plurality of said wireless networking radio units to remote correspondent wireless networking radio and the networks behind them; and

said FWNE device performing as central networking feature means for the networking communication among all the said remote wireless networking radio and the networks behind them.

19 (new). Apparatus according to claim 18 wherein one of the said remote networks is the main network.

20 (new). Apparatus according to claim 10 for interconnecting a plurality of networks, comprising:

having a said FWNE device of claim 10 configured with a plurality of said wireless networking radio units; and

communicating a plurality of said wireless networking radio units to remote correspondent wireless networking radio and the networks behind them; and

having a said FWNE device of claim 10 configured with a plurality of said wired networking units; and

connecting a plurality of said wired networking units to correspondent wired networks; and

said FWNE device performing as central networking feature means for the networking communication among all the said remote wireless networking radio and the networks behind them.

21 (new). Apparatus according to claim 20 wherein one of the said remote networks is main network.

22 (new). Apparatus according to claim 20 wherein one of the said wired networks is main network.

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FIXED WIRELESS NETWORK EXTENDER

Abstract:

A processor unit (164) with two system buses: bus1 (161) and bus2 (162), which multiple wireless networking radio units (102,112,122,132) and multiple wired networking units (165,166,167,168) can be connected to. The processor unit (164) is the system-operating platform, [[and dose the]] and perform the networking functions among the networking units. A radio control unit (163) [[monitor and control the physical part of radio]] monitors and controls the physical layer of radio performance. Each wireless networking radio unit (102,112,122,132) [[as long as each directional antenna]] and correspondent directional antenna (101,111,121,131) will communicate with remote same type of wireless networking device and form a wireless network link. Multiple wired networking units (165,166,167,168) can connect [[to wired network]] to wired networks. The number and type of the wireless networking radio units (102,112,122,132) and wired networking units (165,166,167,168) can be [[selected, installed according to specific networking requirement, thus configure]] selected and installed according to specific networking requirement to configure the hardware system of the device. The Fixed Wireless Network Extender (FWNE) device (10) can be configured with multiple different wireless networking radio units, to communicate with multiple different wireless networks, extend the range of the wireless network.